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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte FRANK KIEBLICH, SVEN CRONE, OTTO MACHHAMMER, FREDERIK VAN LAAR, EKKEHARD SCHWAB, and GOTZ-PETER SCHINDLER

Appeal 2016-002401
Application 12/091,874
Technology Center 1700

Before ADRIENE LEPIANE HANLON, MONTÉ T. SQUIRE, and MICHAEL G. McMANUS, *Administrative Patent Judges*.

SQUIRE, *Administrative Patent Judge.*

DECISION ON APPEAL[1]

Appellants[2] appeal the Examiner's decision finally rejecting claims 23, 25–36, 39–41, and 44–46. 35 U.S.C. § 134(a). We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] In our Decision, we refer to the Final Office Action appealed from, mailed October 8, 2014 ("Final Act."); the Appeal Brief dated June 5, 2015 ("App. Br."); the Examiner's Answer to the Appeal Brief dated October 23, 2015 ("Ans."); and the Reply Brief dated December 22, 2015 ("Reply Br.").

[2] Appellants identify BASF SE as the Real Party in Interest. App. Br. 2.

The Claimed Invention

Appellants' disclosure relates to a method for producing aromatic hydrocarbons from C_1-C_4-alkanes, or a mixture of C_1-C_4-alkanes, and utilization of C_1-C_4-alkane-comprising product streams. Spec. 1; Abstract. Independent claim 23 is illustrative of the claimed subject matter on appeal and is reproduced below from the Claims Appendix to the Appeal Brief (App. Br. 22, 23) (key disputed claim language italicized):

> 23. A method for producing an aromatic hydrocarbon from a C_1-C_4-alkane, or a mixture of C_1-C_4-alkanes consisting of
>
> a) bringing a feedstock stream A which comprises a mixture of C_1-C_4-alkanes, containing at least 70 mol% of methane and further 0.01 to 15 mol% of ethane, 0.01 to 10 mol% of propane, 0 to 0.06 mol% of butane and higher hydrocarbons, 0 to 0.15 mol% of nitrogen, 0 to 0.3 mol% of hydrogen sulfide and 0 to 0.30 mol% of impurities, into contact with a catalyst and reacting a part of the C_1-C_4-alkane, or a part of the mixture of the C_1-C_4-alkanes, respectively, to form aromatic hydrocarbon(s) resulting in a product stream B containing the aromatic hydrocarbon(s), unreacted C_1-C_4-alkane or mixture of unreacted C_1-C_4 alkanes, respectively, hydrogen, and inert substances including nitrogen, if present;
>
> b) fractionating the product stream B resulting from step a) into a low-boiler stream C which comprises a majority of the hydrogen and of the unreacted C_1-C_4-alkane, or of the mixture of unreacted C_1-C_4-alkanes, respectively, wherein the low-boiler stream C further comprises the inert substances including nitrogen, if present, of the feedstock stream A, reacted and partially reacted alkanes, byproducts formed and impurities already present in feedstock stream A, and a high-boiler stream D, or a plurality of high-boiler streams D', which stream D or streams D' comprises or comprise a majority of the aromatic hydrocarbon formed; and
>
> c) *feeding the low-boiler stream C to a further C_1-C_4-alkane-consuming method to produce synthesis gas*; and

d) directly synthesizing ammonia using the synthesis gas of step c).

The References

The Examiner relies on the following prior art references as evidence in rejecting the claims on appeal:

Banquy	US 4,524,056	June 18, 1985
Bricker	US 5,026,937	June 25, 1991
Viteri et al., (hereinafter "Viteri")	US 6,170,264 B1	Jan. 9, 2001
Allison et al., (hereinafter "Allison")	US 2003/0144565 A1	July 31, 2003

The Rejections

On appeal, the Examiner maintains the following rejections:

1. Claims 23, 25–28, 30, 31, 34–36, 39–41, and 45 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bricker in view of Banquy ("Rejection 1"). Ans. 2; Final Act. 2.

2. Claims 29, 32, and 33 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bricker in view of Banquy as applied to claim 23 above and further in view of Allison ("Rejection 2"). Ans. 4; Final Act. 4.

3. Claim 44 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Bricker in view of Banquy as applied to claim 23 above and further in view of Viteri ("Rejection 3"). Ans. 5; Final Act. 5.

4. Claim 46 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Bricker in view of Viteri ("Rejection 4"). Ans. 6; Final Act. 6.

OPINION

Having considered the respective positions advanced by the Examiner and Appellants in light of this appeal record, we affirm the Examiner's rejections for the reasons set forth in the Answer to the Appeal Brief and Final Office Action appealed from, which we adopt as our own. We, nonetheless, highlight and address specific findings and arguments for emphasis as follows.

Rejection 1

In response to this rejection, Appellants present argument for the separate patentability of claims 23 and 31 only. App. Br. 9, 15. We, therefore, select claims 23 and 31 as representative and the remaining claims subject to this rejection stand or fall with claims 23 and 31. 37 C.F.R. § 41.37(c)(1)(iv).

Claim 23. The Examiner determines that the combination of Bricker and Banquy suggests a process for making aromatic hydrocarbons satisfying all of the limitations of claim 23 and would have rendered claim 23 obvious. Ans. 2, 3.

The Examiner finds that Bricker teaches the majority of the limitations of claim 23, except that the reference does not explicitly teach feeding the light hydrocarbon of step (c) to a further downstream processing. *Id.* at 2, 3 (citing Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col. 11, ll. 4–40, 35–37, 43–69). The Examiner, however, relies on Banquy for teaching this missing limitation. *Id.* at 3.

In particular, the Examiner finds that Banquy teaches a process for the production of ammonia comprising gasifying a carbon-containing feedstock including methane and a source of hydrogen with air to produce raw

synthesis gas comprising nitrogen, hydrogen, carbon oxides, and methane. Ans. 3 (citing Banquy, col. 2, l. 52). The Examiner also finds that the synthesis gas is further processed to produce ammonia and that ammonia production depends on a good H_2/N_2 ratio. *Id.* at 3 (citing Banquy, col. 2, l. 5, col. 3, l. 9).

Based on the above findings the Examiner concludes:

> It would have been obvious to one having ordinary skill in the art to modify Bricker with Banquy's process by carrying the hydrogen-methane stream to a syngas production, instead of recycling to the aromatic production unit, for producing ammonia, because Banquy teaches that ammonia synthesis depends on the H_2/N_2 ratio to maintain the stoichiometry . . . [and one skilled in the art] would be motivated to synthesize a stream to produce ammonia since ammonia is a valuable product.

Ans. 3.

Appellants argue that the Examiner's rejection of claim 31 should be reversed because: (1) one of ordinary skill in the art would have had no reason or rationale to combine Bricker and Banquy (App. Br. 10); (2) the cited references do not teach or suggest to a person of ordinary skill in the art that the recycle stream of Bricker would be suitable for producing ammonia and doing so would render Bricker's process "unfit for the intended purpose" (*id.* at 12, 13); (3) there is no teaching or suggestion to a person of ordinary skill in the art that the low boiler stream C of claim 23 could be used in Banquy's process to form ammonia (*id.* at 13); and (4) the rejection is the result of an "impermissible degree of hindsight" (*id.* at 13, 14).

We do not find Appellants' arguments persuasive of reversible error in the Examiner's analysis and findings. On the record before us, we find

that a preponderance of the evidence and sound technical reasoning support the Examiner's analysis and determination (Ans. 2, 3) that the combination of Bricker and Banquy suggests all of the limitations of claim 23 and would have rendered the claim obvious. Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col. 11, ll. 4–40, 35–37, 43–69; Banquy, col. 2, ll. 5, 52, col. 3, l. 9.

The Examiner also provides a reasonable basis and identifies a preponderance of the evidence in the record to evince why one of ordinary skill would have combined the teachings of the references to arrive at Appellants' claimed invention. Ans. 3 (explaining that one of ordinary skill would have had reason to modify Bricker's process for making aromatic hydrocarbons to incorporate downstream Banquy's process for producing ammonia because Banquy teaches that ammonia synthesis depends on the H_2/N_2 ratio to maintain the stoichiometry and, like aromatic hydrocarbons, ammonia is likewise a valuable product); *see also KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 420 (2007) (explaining that any need or problem known in the art can provide a reason for combining the elements in the manner claimed).

In particular, as the Examiner finds and explains at pages 7 through 8 of the Answer, because Banquy discloses that the feedstream for its ammonia synthesis process comprises predominantly methane (Banquy, col. 1, l. 66–col. 2, l. 5) and Bricker discloses that the aromatization effluent stream from its process is recovered to produce a byproduct stream of light hydrocarbons including methane (Bricker, col. 1, l. 20), one of ordinary skill in the art would have been motivated to utilize Bricker's byproduct methane

stream as Banquy's feedstream in order to make two valuable products: ammonia and aromatics.

Appellants fail to direct us to sufficient evidence or provide an adequate technical explanation to establish why the Examiner's articulated reasoning for combining the teachings of the prior art to arrive at the claimed invention lacks a rational underpinning or is otherwise based on some other reversible error.

Moreover, Appellants' disagreement with the Examiner's reasoning for combining the references, without more, is insufficient to establish reversible error. *KSR*, 550 U.S. at 420; *cf. also SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1320 (Fed. Cir. 2006) ("[M]ere statements of disagreement . . . as to the existence of factual disputes do not amount to a developed argument.").

Appellants' arguments that "there is nothing in Bricker to suggest utilizing the effluent stream to form ammonia" and that "there is nothing in Banquy to suggest that the low boiler stream C could be used in the process" (App. Br. 10) are not persuasive of reversible error because they are premised on what Appellants contend Bricker and Banquy each teaches or suggests individually, and not the combined teachings of the references as a whole and what the combined teachings would have suggested to one of ordinary skill in the art. One cannot show non-obviousness by attacking references individually where the rejection is based on a combination of references. *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

Appellants' contentions that the Examiner's combination of Bricker and Banquy would "render the process unfit for the intended purpose of Bricker" and "lower the overall yield of valuable aromatic hydrocarbons"

(App. Br. 12, 13) are not persuasive because they are speculative and conclusory, and Appellants do not provide an adequate technical explanation or direct us to sufficient evidence in the record to support them. *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984).

Appellants' impermissible hindsight argument (App. Br. 13, 14) is equally unpersuasive because it is conclusory and, without more, insufficient to rebut or otherwise establish reversible error in the Examiner's findings and analysis. *De Blauwe*, 736 F.2d at 705 (Fed. Cir. 1984).

Moreover, as previously discussed above, we find that the Examiner's analysis and obviousness conclusion are well-supported by a preponderance of the evidence and sound technical reasoning. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

At page 14 of the Appeal Brief, Appellants seem to argue that the process of claim 23 is non-obvious because it yields unexpected results. In particular, relying on the results set forth in Table 5 of the Specification, Appellants contend that because a lower amount of methane is necessary than when pure methane is used

> [t]he heat demand in the production of synthesis gas is therefore significantly lower in the case of the use according to the invention of the low-boiler stream C in the ammonia synthesis than when methane is used as feedstock.

App. Br. 14, 15 (quoting Spec. 20). Appellants contend that "this improved result would not have been expected." *Id.* at 15.

We do not find this argument persuasive. In attempting to overcome a prima facie case of obviousness by showing unexpected results, the burden rests with Appellants to establish: (1) that there actually is a difference

between the results obtained through the claimed invention and those of the prior art and (2) that the difference actually obtained would not have been expected by one skilled in the art at the time of the invention. *See In re Freeman*, 474 F.2d 1318, 1324 (CCPA 1973) (citations omitted); *In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972) ("the burden of showing unexpected results rests on he who asserts them").

Appellants have failed to satisfy the requisite burden. Appellants do not identify sufficient evidence to show that there actually is a difference between the results set forth in Table 5 of the Specification (Spec. 20) and those of the closest prior art, i.e., Banquy's process. Appellants also do not adequately explain or provide data sufficient to show how Banquy's prior art process would have performed or been expected to perform by one skilled in the art if its process and the resulting process streams were subject to the same testing listed in Table 5 of the Specification and referenced in the Appeal Brief.

Appellants' contention that "this improved result would not have been expected" (App. Br. 15) is not persuasive because it is conclusory and rests entirely on attorney argument and, without more, is insufficient to establish unexpected results. *De Blauwe*, 736 F.2d at 705 ("It is well settled that unexpected results must be established by factual evidence. Mere argument or conclusory statements in the specification does not suffice.").

Claim 31. Claim 31 depends indirectly from claim 23 and adds the limitation "wherein the reaction of the C_1-C_4-alkane or of the mixture of the C_1-C_4-alkanes is conducted autothermally." App. Br. 24 (Claims App'x).

Appellants argue that the Examiner's rejection of claim 31 should be reversed for the same reasons previously presented above in response to the

Examiner's rejection of claim 23. App. Br. 15. We do not find this argument persuasive for the same reasons discussed above regarding the patentability of claim 23.

Appellants further argue that the Examiner's rejection of claim 31 should be reversed because the combination of Bricker and Banquy does not teach or suggest the limitation "wherein the reaction of the C_1-C_4-alkane or of the mixture of the C_1-C_4-alkanes is conducted autothermally." App. Br. 15. In particular, Appellants contend that the Examiner erred because the presence of a heating fluid is not an indication of an autothermal system and a person of ordinary skill in the art would understand such disclosure as indicating that an external heat source in the form of a heating fluid is introduced into the system. *Id.* at 16.

We do not find this argument persuasive for the well-stated reasons provided by the Examiner at pages 4 and 15 of the Answer. In particular, we find that a preponderance of the evidence and sound technical reasoning support the Examiner's findings that Bricker suggests the "conducted autothermally" limitation of claim 31. Bricker, col. 3, ll. 54–56, col. 4, ll. 24–30.

As the Examiner finds (Ans. 15), Bricker discloses that the reaction to produce aromatics is "very endothermic" (Bricker, col. 4, ll. 54–56) and heating may occur via oxidative heating, which involves the selective oxidation of hydrogen and combustion of the hydrogen generated in the aromatization process; and that oxidative heating is "beneficial in an endothermic hydrogen-producing process." (*id.* at col. 4, ll. 24–30). As the Examiner further finds (Ans. 15), Bricker's disclosure regarding oxidative heating is the same type of heat supply that Appellants describe and

characterize as autothermal at page 15 of the Appeal Brief. Bricker's disclosure is also consistent with the "autothermal procedure," as disclosed in Appellants' Specification. *See* Spec. 4, ll. 13–16 (disclosing that under the autothermal procedure "the endothermic target reaction is thermally coupled to a second reaction which makes up the balance of the exothermy"), 23–25 (disclosing that the second reaction is an oxidation).

Appellants' argument, without more, exposes no reversible error in the Examiner's analysis and factual findings in this regard.

Accordingly, we affirm the Examiner's rejections of claims 23, 25–28, 30, 31, 34–36, 39–41, and 45 under 35 U.S.C. § 103(a) as obvious over the combination of Bricker and Banquy.

Rejection 2

In response to this rejection, Appellants present argument for the separate patentability of claim 32 only. App. Br. 16. Accordingly, we select claim 32 as representative and claims 29 and 33 stand or fall with claim 32. 37 C.F.R. § 41.37(c)(1)(iv).

Claim 32 depends from claim 23 and recites the "method according to claim 23 comprising recirculating to a reaction zone of step a), a part of the product stream B before separating off the high boilers or aromatic hydrocarbons." App. Br. 24 (Claims App'x).

The Examiner determines that the combination of Bricker, Banquy, and Allison suggests a process satisfying all of the limitations of claim 32, including the "recirculating to a reaction zone of step a)" limitation, and that the combination would have rendered claim 32 obvious. Ans. 4, 5, 16 (citing Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col.

11, ll. 4–40, 35–37, 43–69; Banquy, col. 2, ll. 5, 52, col. 3, l. 9; Allison ¶¶ 46–49, 62, Fig. 2,).

Appellants argue that the Examiner's rejection of claim 32 should be reversed for the same reasons previously presented above in response to Rejection 1. App. Br. 15. We do not find this argument persuasive for the same reasons discussed above in affirming the Examiner's Rejection 1.

Appellants further argue that the Examiner's rejection should be reversed because Allison does not teach or suggest the limitation "recirculating to a reaction zone of step a), a part of the product stream B before separating off the high boilers or aromatic hydrocarbons," as recited in the claim. App. Br. 16. Appellants contend that the portion of Allison relied upon by the Examiner makes clear that the intermediate recycle takes place only after a separation to remove aromatics and not before a separation step as required by claim 32. *Id.* at 17.

We do not find Appellants' argument persuasive of reversible error for largely the same reasons and factual findings provided by the Examiner at pages 4, 5, and 16 of the Answer. In particular, we agree with the Examiner's finding (Ans. 16) that Allison teaches that hydrogen stream **20** is recovered from the reaction zone **18** *before* aromatic product separation unit **24**, and that stream **20** may be recycled using techniques known to those skilled in the art. Allison, Fig. 2, ¶ 62.

In view of Allison's teachings and the combined teachings of the prior art as a whole, we find that a preponderance of the evidence and sound technical reasoning support the Examiner's finding (Ans. 4, 5, 16) that the combination of Bricker, Banquy, and Allison suggests all of the limitations of claim 32, including recirculating to a reaction zone of step a), a part of the

product stream B before separating off the high boilers or aromatic hydrocarbons. Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col. 11, ll. 4–40, 35–37, 43–69; Banquy, col. 2, ll. 5, 52, col. 3, l. 9; Allison ¶¶ 46–49, 62, Fig. 2.

Accordingly, we affirm the Examiner's rejections of claims 29, 32, and 33 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Bricker, Banquy, and Allison.

Rejection 3

Claim 44 depends from claim 23 and adds the limitation "wherein the C_1-C_4-alkane consuming method is combustion in a combined cycle gas turbine." App. Br. 25 (Claims App'x).

The Examiner finds that the combination of Bricker, Banquy, and Viteri suggests a process satisfying all of the limitations of claim 44, and concludes that the combination would have rendered claim 44 obvious. Ans. 5, 6 (citing Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col. 11, ll. 4–40, 35–37, 43–69; Banquy, col. 2, ll. 5, 52, col. 3, l. 9; Viteri, Abstract).

Appellants argue that the Examiner's rejection of claim 44 should be reversed for the same reasons previously presented above in response to Rejection 1. App. Br. 15. We do not find this argument persuasive for the same reasons discussed above in affirming the Examiner's Rejection 1.

Accordingly, we affirm the Examiner's rejection of claim 44 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Bricker, Banquy, and Viteri.

Rejection 4

Independent claim 46 recites language similar to claim 23 and additionally includes the limitation "feeding the low-boiler stream C for combustion in combined heat and power stations to produce energy, heat and/or steam." App. Br. 26 (Claims App'x).

The Examiner finds that the combination of Bricker and Viteri suggests a method for producing an aromatic hydrocarbon from a C_1-C_4-alkane, or a mixture of C_1-C_4-alkanes satisfying all of the limitations of claim 46, and concludes that the combination would have rendered claim 46 obvious. Ans. 6, 7 (citing Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col. 11, ll. 4–40, 35–37, 43–69; Viteri, Abstract).

Appellants argue that the Examiner's rejection should be reversed for reasons similar to those previously presented in response to the Examiner's rejection of claim 23 (Rejection 1). App. Br. 17–19. In particular, Appellants argue that: (1) one of ordinary skill in the art would have had no reason or rationale to combine Bricker and Viteri (App. Br. 17); (2) Bricker does not teach or suggest that its light hydrocarbon stream can be used for anything other than recycling to the reaction to increase the yield of aromatic hydrocarbons (*id.* at 18); (3) the Examiner's proposed modification would render Bricker's process unfit for the intended purpose (*id.* at 19); (4) there is no teaching or suggestion that the composition of the low boiler stream of claim 46 could be used in Viteri's process (*id.* at 19); and (5) the rejection is the result of impermissible hindsight (*id.* at 19).

We do not find Appellants' arguments persuasive of reversible error for the well-stated reasons provided by the Examiner at pages 6, 7, and 16–

19 of the Answer and essentially the same reasons discussed above in affirming the Examiner's Rejection 1.

Moreover, on the record before us, we are persuaded that the Examiner's findings and analysis (Ans. 6, 7) are well-supported by a preponderance of the evidence and based on sound technical reasoning. Bricker, Abstract, col. 2, ll. 54, 57, 67, col. 2, l. 66–col. 3, l. 1, col. 11, ll. 4–40, 35–37, 43–69; Viteri, Abstract.

Appellants' arguments, without more, are insufficient to rebut or otherwise establish reversible error in the Examiner's analysis and factual findings in this regard.

Accordingly, we affirm the Examiner's rejection of claim 46 under 35 U.S.C. § 103(a) as being unpatentable over the combination of Bricker and Viteri.

DECISION/ORDER

The Examiner's rejections of claims 23, 25–36, 39–41, and 44–46 are affirmed.

It is ordered that the Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED